Block 2-4

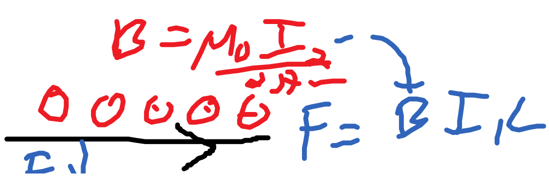
1. F=BIL $B=\mu_o I/(2\pi r)$
   $F=[\mu_o I_1/(2\pi r)]I_2 L$
   $F=[2x10^{-7}x3.0A/0.02m]x4.0Ax0.40cm$
   (2x3/0.02)x4x0.4=480.0
   $4.8x10^{-5}$N away from each other (RHR)
2.
a) RHR - clockwise and constant (change is out of the page and constant, so induced current creates B into the page and constant)
b) emf=NBA/t = 50x(0.25+0.50) x(3.14159x0.04x0.04)/0.3=0.62832 V
   I=V/R = 0.62832/0.5=1.25664 1.3A

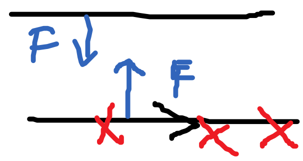
3. V_{back}=emf-Ir
   r=V/I no rotation   r= 6/8=0.75 ohms
   Vback = 6-(4x0.75)=3.0 V

4. X to Y, current opposes change in flux

no B to B left, so induced current creates B right, thumb right fingers show current X to Y.

Block 2-3





$$F = \frac{\mu_0 I_2}{2\pi r} I_1 L$$

1. F=BIL $B=\mu_o I/(2\pi r)$
   $F=[\mu_o I_1 /(2\pi r)] I_2 L$
   $F=[2x10^{-7}x2.0A/0.02m]x5.0Ax0.40cm$
   (2x2/0.02)x5x0.40=400
   $4.0x10^{-5}$N towards each other (RHRs)
   2

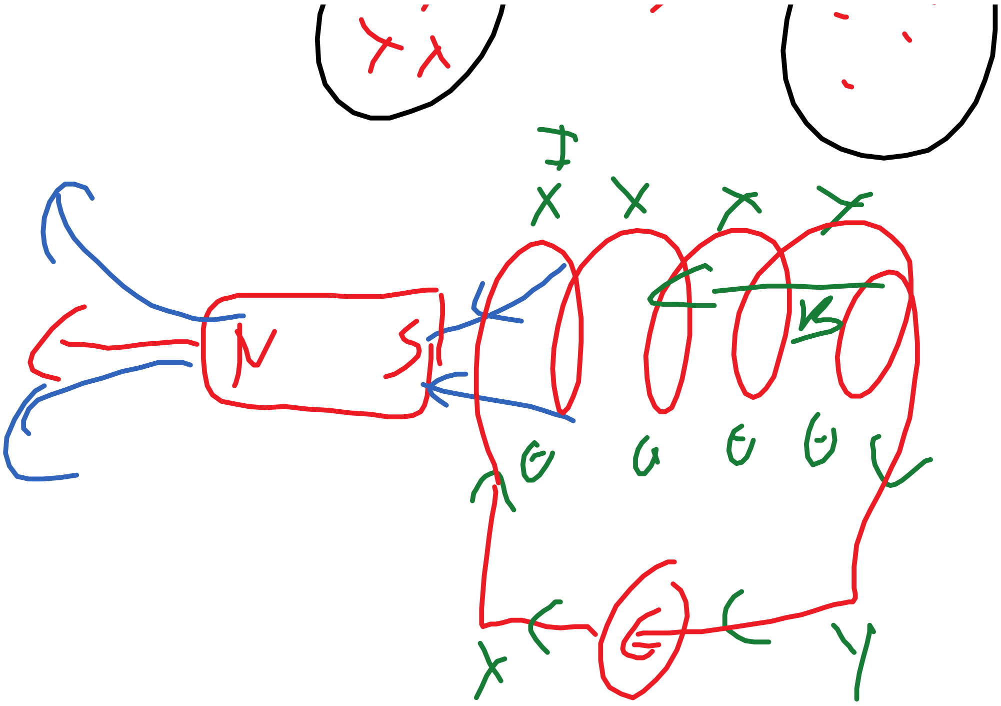
a) RHR - clockwise and constant (change is out of the page and constant, so induced current creates B into the page and constant)

b) emf=NBA/t = 90x(0.25+0.50) x(3.14159x0.04x0.04)/0.3=1.13097 V
   I=V/R = 1.13097/0.5=2.26194 = 2.3A

1. V_{back}=emf-Ir
   r=V/I no rotation   r= 6/8=0.75 ohms
   Vback= 6-(3x0.75)=3.75 =3.8 V (3.7 V or 3.75V OK)

2. Y to X, current opposes change in flux

   B to the left changes to no B, so induced current creates B left, thumb left fingers show current X to Y in the solenoid, so Y to X in the galvanometer.

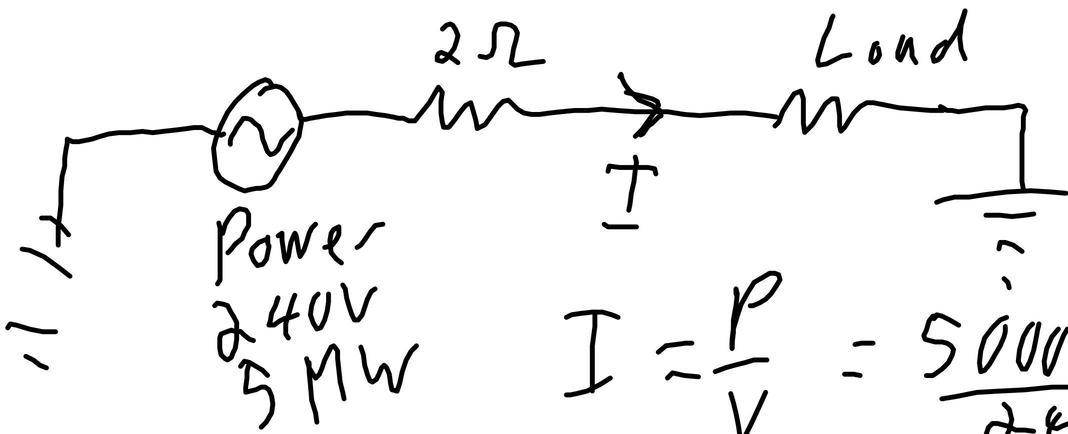


eg. a generator provides 240V and 5.0×10^6W of power through 2.0 ohm transmission cables. How much power is lost by heat in the cables if

a) no transformer?

b) a transformer with 10 loops in the primary and 100 loops in the secondary is used before the cables?

c) what if the secondary has 1000 loops?



$$I = \frac{P}{V} = \frac{5000000\,W}{240\,V}$$

$$= 2.1 \times 10^4\ A$$

$= \underline{2.1 \times 10^4}$

$P = I^2 R = (2.1 \times 10^4 w)^2 (2)$

Not Possible

b) $\frac{N_p}{N_s} = \frac{I_s}{I_p}$

$\frac{10}{100} = \frac{I_s}{2.1 \times 10^4}$ $I_s = 2.1 \times 10^3$

$P_{lost} = (2.1 \times 10^3)(2)$

Still not possible

c) $(2.1 \times 10^2)^2 (2) = \boxed{8.8 \times 10^4 \text{ w}}$

Possible but still bad

Block 2-2

1. F=BIL $B = \mu_o I/(2\pi r)$

   $F = [\mu_o I_1 /(2\pi r)] I_2 L$

$F=[2x10^{-7}x2.0A/0.02m]x4.0Ax0.40cm$
(2x2/0.02)x4x0.4=320
$3.2x10^{-5}N$ away from each other (RHR)
2
a) RHR - clockwise and constant (change is out of the page and constant, so induced current creates B into the page and constant)
b) emf=NBA/t = 70x(0.25+0.50) x(3.14159x0.04x0.04)/0.3=0.87965 V
I=V/R = 0.87965/0.5=1.7593 =1.8A

3. V_{back}=emf-Ir
r=V/I no rotation r= 6/8=0.75 ohms
Vback = 6-(2x0.75)=4.5 V

X to Y, current opposes change in flux

no B to B left, so induced current creates B right, thumb right fingers show current X to Y.